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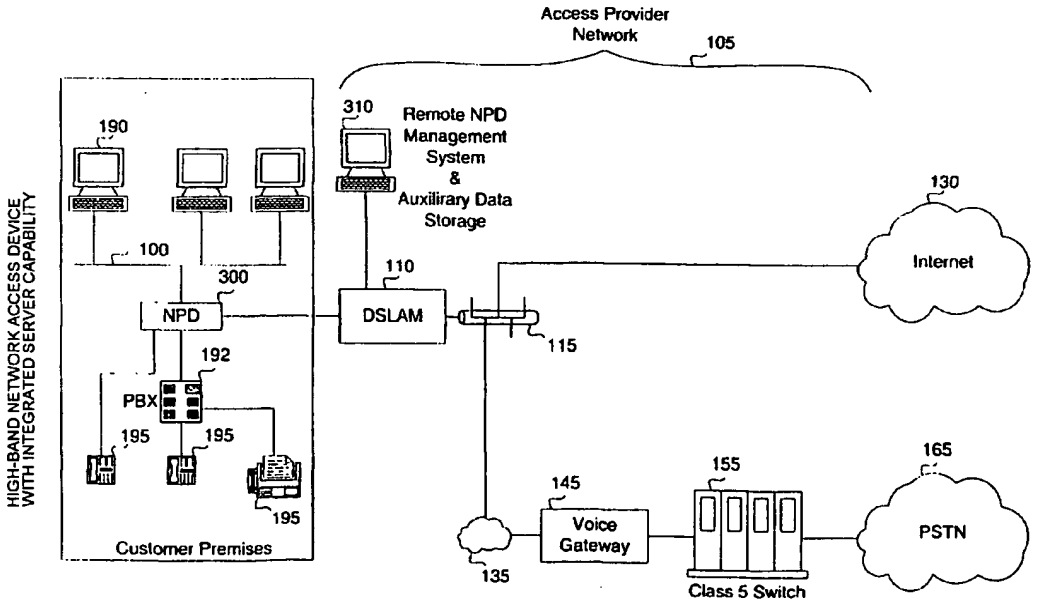
(54) Title: HIGH-BANDWIDTH NETWORK ACCESS DEVICE WITH INTEGRATED SERVER CAPABILITY



(57) Abstract: An apparatus for generating and providing services from a network to a user device including a POTS device and a computer. The apparatus includes a port for providing a physical interface to the network, an access controller coupled to the port, and a network controller coupled to the access controller, the access controller and the network controller being coupled to the user device.

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HIGH-BANDWIDTH NETWORK ACCESS DEVICE WITH INTEGRATED SERVER CAPABILITY

BACKGROUND

Field of the Invention

The present invention relates generally to network access devices, and more particularly to a network access device with embedded network server functionality.

Description of the Background Art

The use of web servers to provide Internet related dial-up services is well known in the art. Known systems provide the hardware and necessary application software to fulfill the needs of Internet Service Providers and their customers. In addition, the use of network access devices such as modems, conversion devices, routers, voice-over-IP (VoIP) access devices, is well known in the art. Such devices provide, when configured in a functional system architecture, the hardware and operating system software necessary to access the full range of services offered over the Internet. A trend in the evolution of networking and communication technology is to provide highbandwidth access to the Internet through technologies such as digital subscriber line (DSL), and its variations (e.g., ADSL, SDSL).

FIG. 1 illustrates a conventional system in which DSL customers connect their local area network (LAN) 100 to the Internet 130 through an access provider, which is often a competitive local exchange carrier (not shown), and an Internet Service Provider (ISP) 120. The access provider maintains the network 105. The ISP 120 delivers services that travel over the access provider's network 105.

FIG. 2 illustrates the conventional architecture ISP 120. Original ISP content along with incoming Internet content is routed from a router/firewall 140 through line 160 and, ultimately, to the customer premises. Conversely, customer Internet packets are routed into ISP servers 210 though 250 and if necessary back out through router/firewall 140 and a line 170 and onto the Internet. The servers 210 through 250 provide services such as web, email, caching, domain name, and FTP, respectively. Thus, an essential aspect of the prior art is that all Internet-related services provided by ISP 120 flow through the ISP's router/firewall 140 and through the servers 210 through 250. One problem with this approach is that typically, ISP's oversubscribe lines 160 and 170, which often results in diminished data transmission rates for the end customer. Another problem is that the centralized nature of servers 210 through 250 raises privacy and security concerns for the end customer.

With reference to FIG. 1 a number of computers 190 including a Local Area Network (LAN) 100 are shown connected to an integrated access device (IAD) 180. Alternatively a single computer 190 may be connected directly to IAD

180 (not shown). The IAD 180 is further operable to carry VoIP communication and thus analog Plain Old Telephone Service (POTS) devices 195 are coupled directly or through a Private Branch Exchange (PBX) 192 to IAD 180.

The access provider aggregates (i.e., multiplexes), via a Digital Subscriber Line Access Multiplexer (DSLAM) 110, data from several customers for the ISP 120 into a backbone network connection 115, such as a DS3, OC3, or T1. Customer data is then be routed out of the backbone 115 and into a regional packet network 125 that is appropriate for the location of the ISP 120. From the regional packet network 125, the data travels over line 160 coupled to the ISP's router/firewall 140. Within the ISP 120 the data is routed through a bank of servers 150 to line 170 for delivery to the Internet 130. A reverse path is followed for content originating at the Internet 130 and destined for the customer premises.

In similar fashion, VoIP communication is routed from the backbone 115 to a regional packet network 135, which is appropriate for the location of a voice gateway 145. The voice gateway 145 converts the packetized VoIP communication back to an analog signal and, through a Class 5 switch 155, sends it through to a PSTN 165.

The prior art suffers from many deficiencies, chief among them the fact that configuring a high-bandwidth access device such as a DSL modem or an IAD 180 to function with a desktop computer 190 is not a simple task. Configuring the system often requires physically connecting the IAD 180 to the

computer motherboard, and reconfiguring the desktop operating system, neither of which are typically simple, straight-forward tasks for an end user.

What is needed is a low cost, easily installed device that integrates Internet server functionality with high-bandwidth access thus providing the capability to bypass the ISP 120 and route Internet traffic directly to the Internet 130. Such a device would preferably provide enhanced accessibility to the Internet for end customers. Such a device would further advantageously function as a peripheral to a personal computer allowing access providers, small to medium-size businesses, and residential users to eliminate server costs and complexity, and essentially become their own Internet service provider. Additionally, such a device would provide voice and integrated dial-up services. Finally such a device would provide increased privacy and security and rapid deployment of high-bandwidth Internet access.

SUMMARY OF THE DISCLOSURE

An apparatus in accordance with the invention generates and provides services from a high bandwidth network to a user device. The apparatus includes a port for providing a physical interface to a high bandwidth network, an access controller coupled to the port, and a network controller coupled to the access controller, the access controller and the network contoller being coupled to a user device. The apparatus generates and provides services to the user device without the need of connecting the user device to the high bandwidth network through an ISP.

In a preferred embodiment of the invention the apparatus includes a network presence device (NPD). The NPD is configured as a low-cost device that is simple to install and to manage, essentially a "plug and go" device. It includes all of the functionality necessary to operate as a secure and private integrated Internet access and server device over a high bandwidth connection to the Internet, such as DSL. In this manner the NPD provides functionality for bypassing the ISP.

The NPD includes a dual controller architecture having two controllers coupled by a programmable logic device. The access controller provides analog services to a plurality of analog devices including POTS devices and facsimile machines. The network or Internet controller provides Internet services to a plurality of computer devices. Suchservices include a web server, a webbased

configuration user interface, e-mail server, a web-based e-mail reader, a firewall, a Dynamic Host Configuration Protocol server, a Network Address Translation server, an FTP server, a telnet server, an SNMP serve, an integrated back-up application, video multicasting gateway, and an auto-configuration daemon.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 3 illustrates a system according to one embodiment of the invention. DSLAM 110 communicates, via backbone 115, directly with the Internet 130. A network presence device (NPD) 300, shown coupled to LAN 100 and other POTS devices at the customer premises, is coupled to DSLAM 110. NPD 300 includes integrated server functionality as further described herein. Remote NPD management system 310 provides for remote management of NPD 300 as well as functioning as auxiliary data storage. Thus management and configuration of NPD 300 occurs in a centralized fashion so that individual customers do not have to deal with such tasks.

FIG. 4 depicts a preferred hardware architecture of the NPD 300. NPD 300 includes an access controller 406 for high bandwidth routing and POTS access and a network or Internet controller 416 for Internet and server applications. The access controller 406 and the Internet controller 416 intercommunicate via LAN transmission technology, such as Ethernet, embodied in a programmable logic device (PLD) 418. The NPD 300 provides a physical interface with a multiplexer, such as DSLAM 110 which is conventionally located at a telephone service central office. In addition, the nNPD300 provides the applications and processing capacity necessary to maintain an Internet presence. In this description, the architecture of the NPD 300 will generally be referred to as

access architecture to reference the architecture and functionality of the NPD 300 to the DSLAM 110 side of the PLD 418, and server architecture to reference the architecture and functionality to the LAN 100 side of the PLD 418.

The access architecture includes a high bandwidth port 402 for connecting the NPD 300 to a high bandwidth (e.g., ADSL, DSL, or T1) transmission line provided by an access provider, typically through DSLAM 110. Additionally, a management port 404 provides a physical interface and protocol necessary for communication between a computer (not shown) and the NPD 300. The connectivity offered by the management port 404 and high bandwidth port 402 allows a user to access NPD 300 software applications (e.g., mail, web sever, operating system, etc.). The management port 404 provides a means by which the NPD 300 can be configured, managed, and diagnosed locally. Alternatively, the configuration, management, and diagnostic functions can be performed remotely through high bandwidth port 402.

The management port 404 provides capability to communicate with both the access and server architectures, via PLD 418. The interface standard utilized by management port 404 is preferably the RS232 standard.

An access memory 408 coupled to access controller 406 provides storage of at least an operating system and a communication protocol stack. SDRAM and flash memory are suitable for use as the access memory 408 to utilize the inherent properties of these types of memory.

The NPD 300 includes multiple analog ports 410 for connecting analog devices such as a PBX 192, or speakerphones and fax machines 195 either directly into the NPD 300 or through a PBX 192. A codec 412 converts the analog signals coming from analog devices 190 and 192through analog ports 410, to digital signals and vice versa. Digital signals are processed by a digital signal processor (DSP) 414. The DSP 414 also functions as an interface for the digital signals transmitted between the codec 412 and the access controller 406. Finally, the access architecture intercommunicates via at least one data bus (not shown).

The access architecture communicates with the server architecture through PLD 418, which facilitates a data transmission protocol such as Transmission Control Protocol/Internet Protocol (TCP/IP). In one aspect of the invention the NPD 300 includes two motherboards connected through an Ethernet interface which allows communication between the motherboards. The motherboards generally correspond to the access controller 406 and the Internet controller 416. This embodiment of NPD 300 contributes to commercially advantageous features, for example, low risk and high reliability of the NPD 300 and ease of administration/diagnosis for the user, through use of well known technologies and components.

The NPD 300 includes the Internet controller 416 which provides Internet services such as described herein. The NPD 300 includes random access memory (RAM) 420 for temporary storage of program instructions, files, and other data, and a non-volatile storage device 422, such as a magnetic hard disk, for storage

of data and applications, for example, an operating system, mail and Internet server applications, personal computer applications, and HTML documents. In one aspect of the invention, the NPD 300 includes a PowerQUICC MPC855T processor available from Motorola, Inc. of Schaumburg, IL, coupled with 32 Megabytes of RAM and a 10 Gigabyte hard drive for providing adequate resources for storing and executing a Linux operating system, as well as the web applications discussed herein.

NPD 300 includes a communication port 424 for providing a physical interface supporting facsimile reception and transmission through a fax modem 470 and a mail application. This feature is beneficial in that it eliminates the need for a separate fax machine. In addition, the communication port 424 supports Point-to-Point Protocol (PPP) for dial-up communication with the NPD 300 from a remote device, thus enabling remote network access.

Network ports 426 are included in NPD 300 for providing an interface between the NPD 300 and a personal computer 190 connected directly or through a LAN 100. The network ports 426 are coupled to a hub 428 for managing and routing communication from the connected computers to the Internet controller 416. In one aspect of the invention, NPD 300 includes a 4port 10/100 dual speed hub to provide an interface for connected devices.

The NPD 300 provides means by which a minimal amount of effort is required to configure the NPD 300 in a functional system configuration. Merely connecting the NPD 300 to a high bandwidth communication line through high

bandwidth port 402 and to one or more computers through a network port 426 are the only steps necessary for a completely functional installation of NPD 300. The necessary software applications, network connectivity and routing software to access and utilize the Internet are all provided within the NPD 300. In addition, the NPD 300 may be remotely diagnosed and managed through a remote server, employing methods, which are described in a separate commonly-owned provisional application, Ser. No. 60/226,417, entitled "Remote Management of an Integrated Network Access and Server Device", filed on August 18, 2000, the disclosure of which is hereby incorporated by reference.

FIG. 5 illustrates software aspects of NPD 300. Software applications running on an operating system platform 500, such as Linux, provide at least the following features in addition to those disclosed above:

(1) A secure web server 530 (also known as an HTTP server). The web server 530 transmits web pages to user computers 190 through the hub 428, network ports 426, and the LAN 100 and can be configured with user scripts to create a personalized networkpresence for the user. With a web server 530 the NPD 300 can execute numerous web-based applications 535, several of which are shown in FIG. 5 and disclosed herein.

(2) A web or LAN based user interface 545 for configuration and control of the NPD 300, presented to the user at a local or remote display monitor through the LAN 100 or through management port 404. As with any web-based

application, client components of the user interface 545 are provided through an HTTP server 530.

(3) An electronic mail server 550 with Pretty Good Privacy (PGP). The NPD 300 directly routes e-mail between the user and the DSLAM 110 bypassing an ISP and its associated security and privacy deficiencies.

(4) A web based electronic mail reader 555 for reading e-mail. Client components of the mail reader 555 are sent via the HTTP server 530.

(5) A firewall 510, which is one or more application programs for protecting resources on a private network from users of other networks. The firewall can be integrated with connected communication peripherals, such as audio conference phones and/or videoconferencing devices, and configured to communicate with the peripherals utilizing the appropriate communication protocols.

(6) A Dynamic Host Configuration Protocol (DHCP) server 560, for centrally managing and automating the assignment of IP addresses in an organization's network.

(7) Network Address Translation (NAT) 520, for masking and translating IP addresses between inside and outside networks.

(8) A File Transfer Protocol (FTP) server 580, for providing capability for exchanging files over a network, including software updates.

(9) Telnet server 570, for accessing the NPD 300 and computers 190 remotely over a network.

(10) Simple Network Management Protocol (SNMP) 540, for managing both the access and server sides of the NPD 300, and for monitoring the performance of NPD 300.

(11) An integrated backup application 575, for pushing files to a locally connected computer 585 acting as a mirror. Integrated backup application 575 also provides packet redirection for redirecting e-mail and server request data packets to an alternate storage device while the system is down. The NPD 300 may optionally be configured with a storage area network (SAN) connector (not shown) for facilitating selective data file backup to a storage server within an enterprise network. Alternatively, a remote management server 310 (FIG. 3) provides the storage capacity for the backup files. The backup application 575 is accessible for configuration, management, and execution via telnet services 570.

(12) Video multi-casting capability for operating as a gateway for video signal transmission. Utilizing this capability, a user can store video files 565 on the storage device 422 of NPD 300 and configure a web page with a link to the video file. Thus, viewers at a connected workstation can view the video by linking to the file through the web page and allowing the HTTP server 530 to respond.

(13) Auto-configuration daemon/service 590, for registering the NPD 300 with an access provider DSLAM 110, for domain name system (DNS) name registration, and IP address assignment. Auto configuration services 590 are triggered by appropriate signals from a hardware detection module 595. If a

user wants to manage the NPD 300, theuser will obtain a personal domain name and be allowed to manage the system through the web based user interface. Alternatively, the NPD 300 is provided with an IP address and automatically configured with a domain name utilizing the autoconfiguration function.

FIG. 6 illustrates the steps of the auto-configuration daemon 590. The auto-configuration daemon 590 is a program that runs continuously waiting for positive hardware detection signals 600. When the NPD 300 is connected to the network, the auto-configuration daemon 590 proceeds to decide if the new connection is not already accounted in the configuration settings 610. If not, the auto-configuration daemon 590 must still decide if manual user management mode is in effect 620. Finally, if appropriate, the auto-configuration daemon 590 will execute the necessary auto configuration routines 630.

The preceding list of software applications is exemplary and not intended to limit the scope of the invention.

It will be recognized by those skilled in the art that, while the invention has been described above in terms of preferred embodiments, it is not limited thereto. Various features and aspects of the abovedescribed invention may be used individually or jointly. Further, although the invention has ben described in the context of its implementation in a particular environment and for particular applications, those skilled in the art will recognize that its usefulness is not limited thereto and that the present invention can be utilized in any number of environments and implementations.

What is claimed is:

1. A device for generating and providing services from a network, the device comprising:

a port for providing a physical interface to the network;

an access controller coupled to the port; and

a network controller coupled to the access controller.

2. The device of claim 1 wherein the access controller is coupled to the network controller by means of a programmable logic device.

3. The device of claim 2 wherein the programmable logic device further comprises an Ethernet interface.

4. The device of claim 1 further comprising a communication port coupled to the network controller.

5. The device of claim 4 wherein the communication port is an RS-232 interface.

6. The device of claim 1 further comprising a management port coupled to the access controller.

7. The device of claim 6 wherein the management port is an RS-232 interface.

8. The device of claim 1 further comprising a plurality of analog ports coupled to the access controller through a codec and a DSP.

9. The device of claim 1 further comprising a plurality of network ports coupled to the network controller through a hub.

10. A method for generating and providing services from a network comprising the steps of:

interfacing to the network;

executing a first set of the instructions in an access controller; and

executing a second set of the instructions in a network controller.

11. The method of claim 10 wherein the step of executing a second set of instructions further comprises locallyconfiguring the second set of instructions.

12. The method of claim 10 wherein the step of executing a second set of instructions further comprises remotely configuring the second set of instructions.

13. The method of claim 10 further comprising the step of mirroring the first and second set of instructions.

14. An apparatus for generating and providing services from a network to a user device, the apparatus comprising:

a port for providing a physical interface to the network;

an access controller coupled to the port;

a network controller coupled to the access controller, the access controller and the network controller being coupled to the user device.

15. The device of claim 14 wherein the user device coupled to the access controller further comprises an analog device.

16. The device of claim 14 wherein the user device coupled to the network controller further comprises a computer.

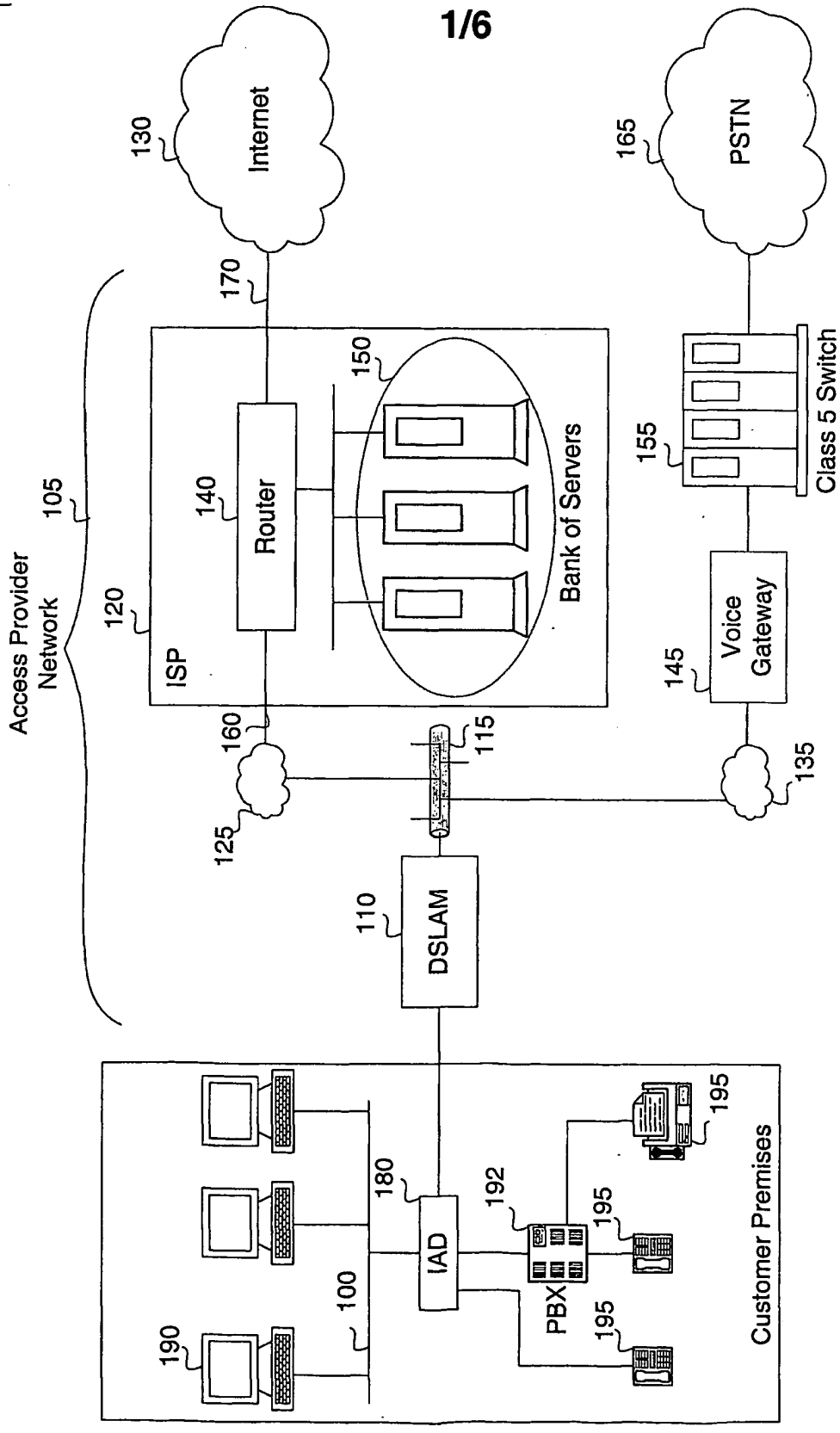

FIG. 1 Prior Art

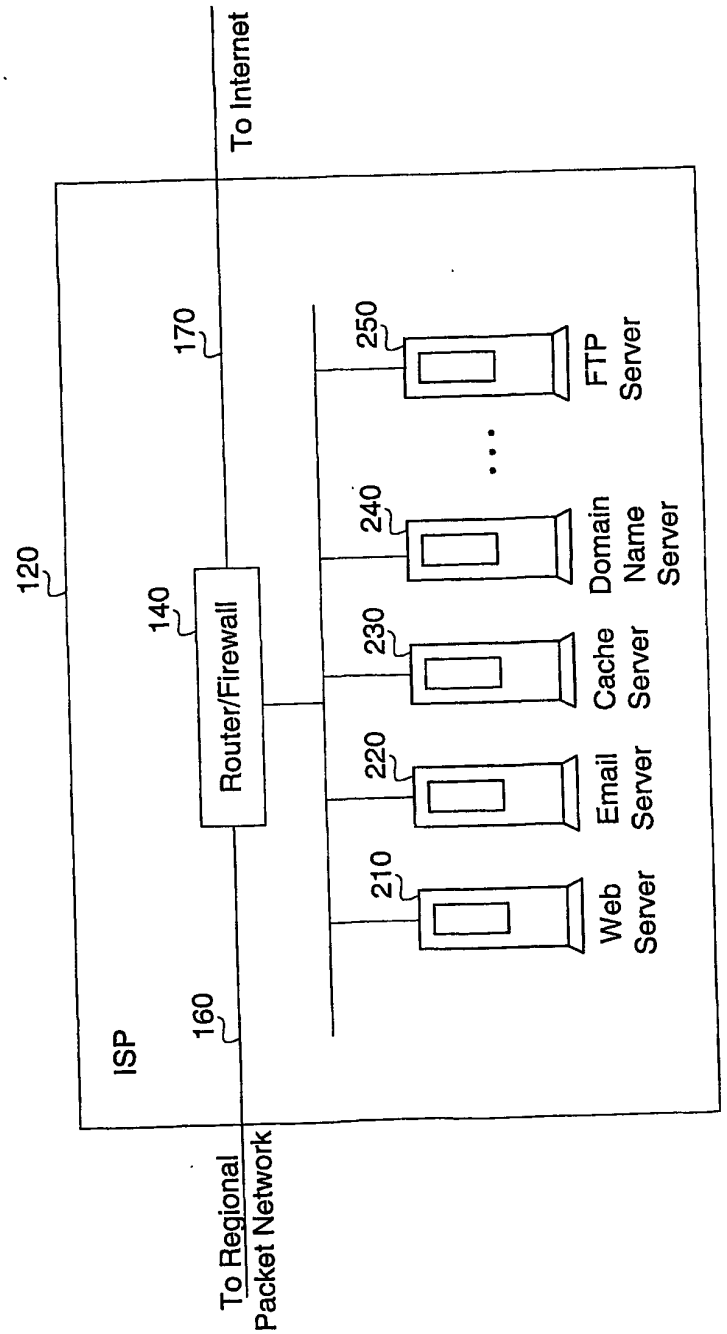

FIG. 2 Prior Art

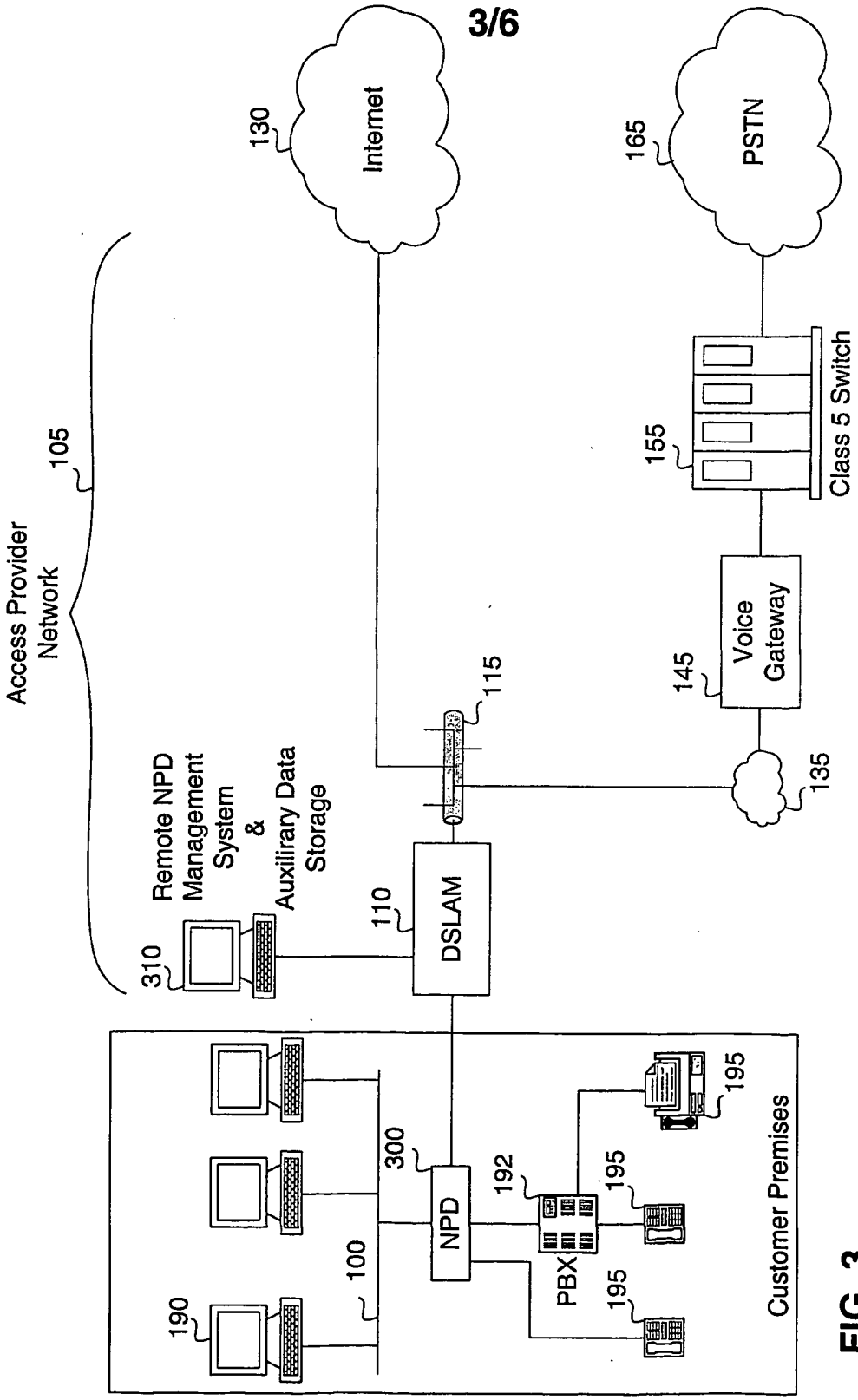
Internet
130
PSTN
165
Access Provider Network
105
Class 5 Switch
155
Voice Gateway
145
115
135
Remote NPD Management System & Auxilirary Data Storage
310
DSLAM
110
300
NPD
192
PBX
195
195
195
100
190
Customer Premises

FIG. 3

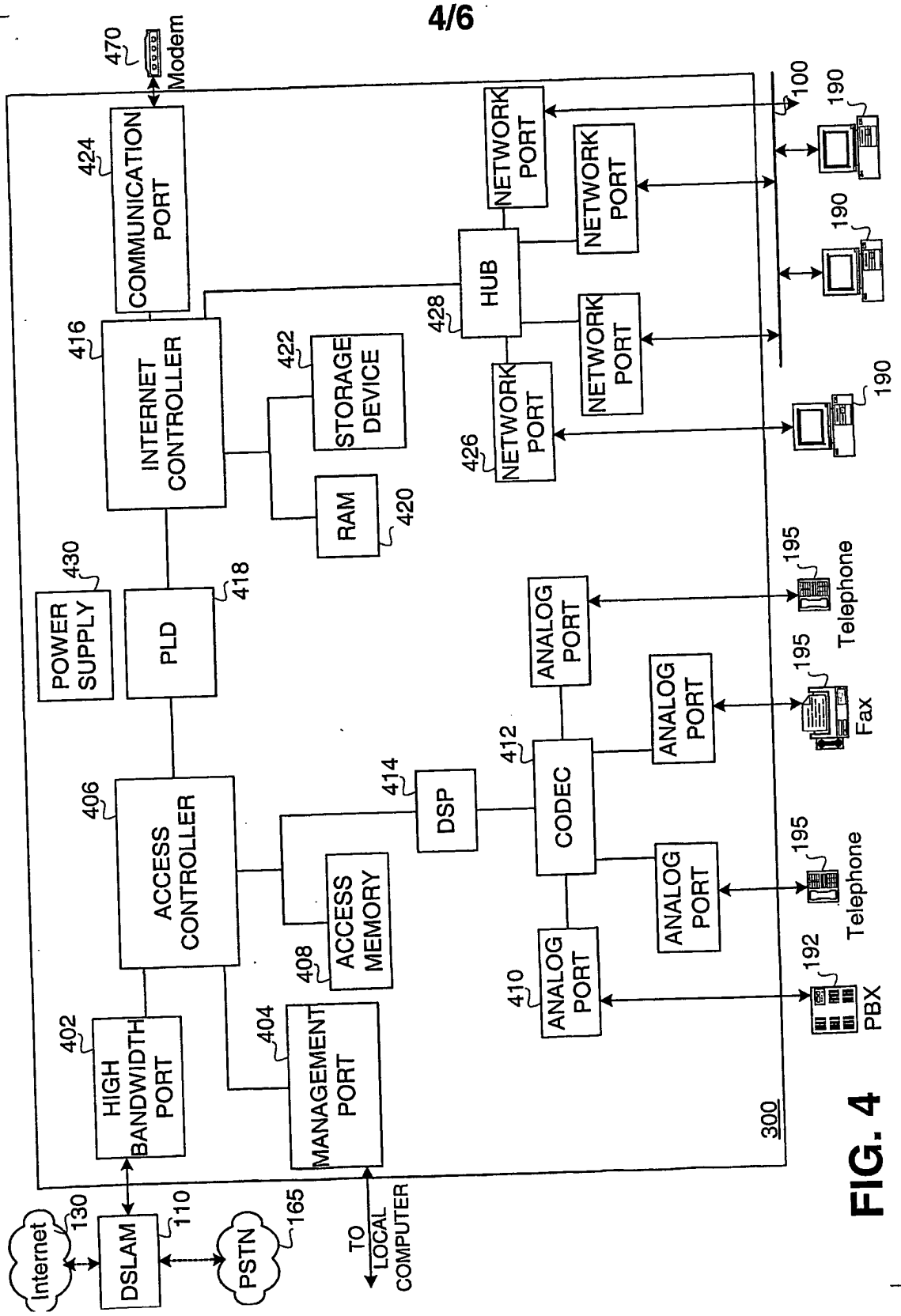
Internet
130
DSLAM
110
PSTN
165
TO LOCAL COMPUTER
300
HIGH BANDWIDTH PORT
402
MANAGEMENT PORT
404
ACCESS MEMORY
408
ACCESS CONTROLLER
406
POWER SUPPLY
430
PLD
418
INTERNET CONTROLLER
416
COMMUNICATION PORT
424
Modem
470
STORAGE DEVICE
422
RAM
420
HUB
428
NETWORK PORT
426
DSP
414
CODEC
412
ANALOG PORT
410
PBX
192
Telephone
195
Fax
195
Telephone
195
100
190

FIG. 4

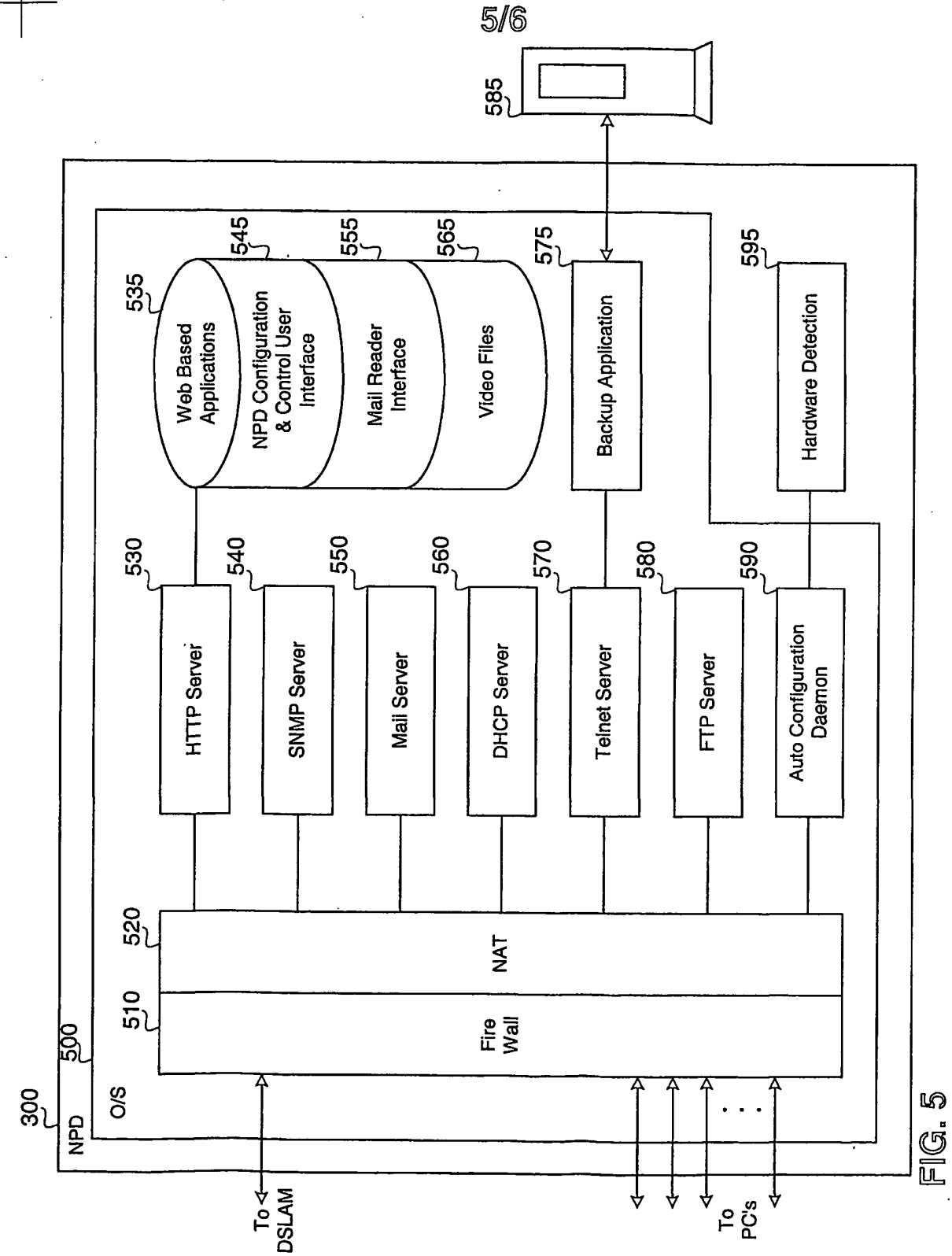
585
545
555
565
575
595
535
Web Based Applications
NPD Configuration & Control User Interface
Mail Reader Interface
Video Files
Backup Application
Hardware Detection
530
540
550
560
570
580
590
HTTP Server
SNMP Server
Mail Server
DHCP Server
Telnet Server
FTP Server
Auto Configuration Daemon
520
NAT
510
Fire Wall
500
O/S
300
NPD
To DSLAM
To PC's

FIG. 5

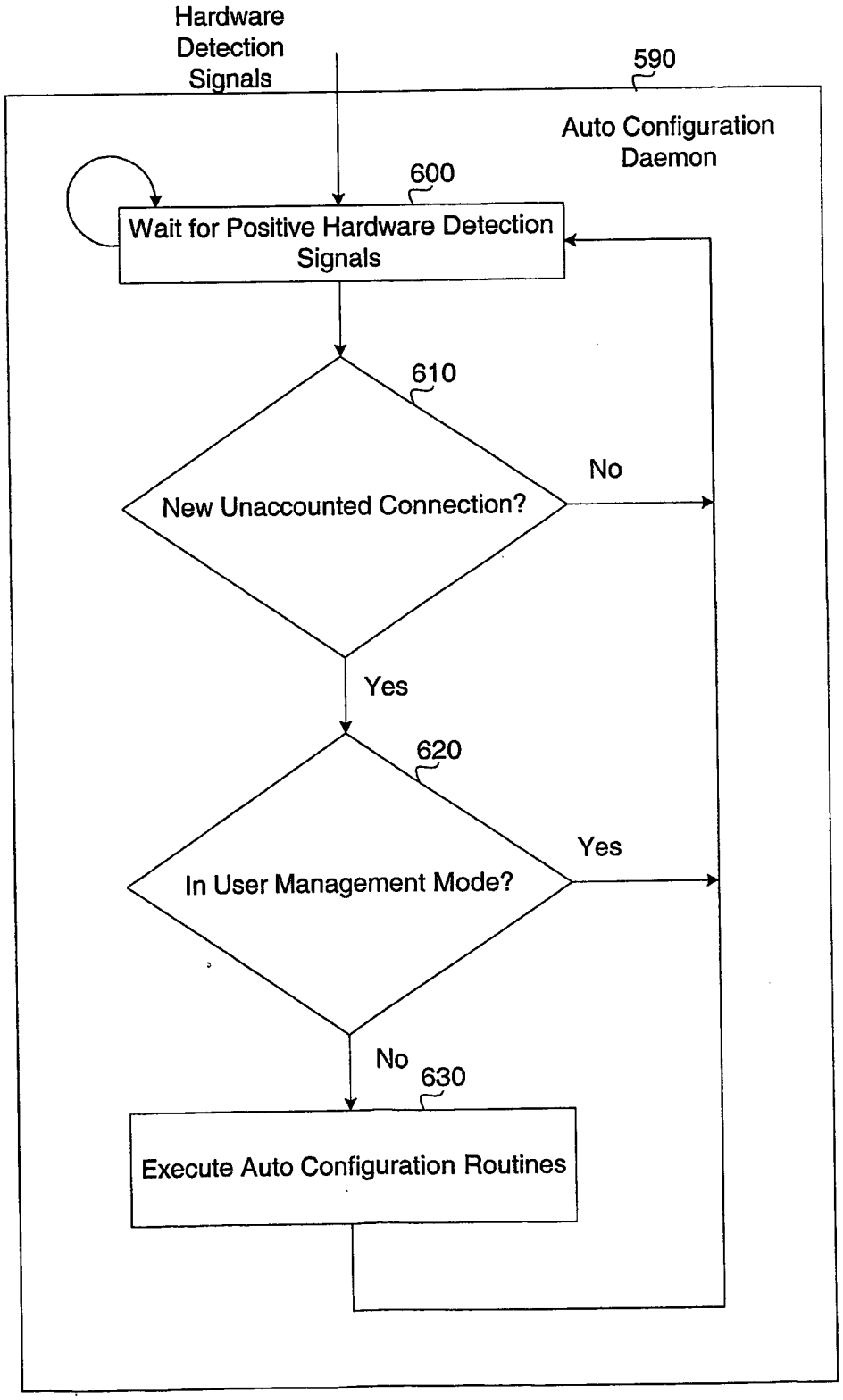
Hardware Detection Signals
590
Auto Configuration Daemon
600
Wait for Positive Hardware Detection Signals
610
New Unaccounted Connection?
No
Yes
620
In User Management Mode?
Yes
No
630
Execute Auto Configuration Routines

FIG. 6